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A Pneumatic Concrete Conveying Mixer.

A combined conveyor and mixer of concrete operated by compressed air, recently developed in Chicago, is a radical departure from the numerous types of continuous and batch mixers now in general use. Conveying, but not mixing, grout by compressed air has been practised on a small scale in Europe for about 25 years. Most of these machines were hand-operated and used for the purpose of waterproofing the outside of masonry tunnels which otherwise would be inaccessible.

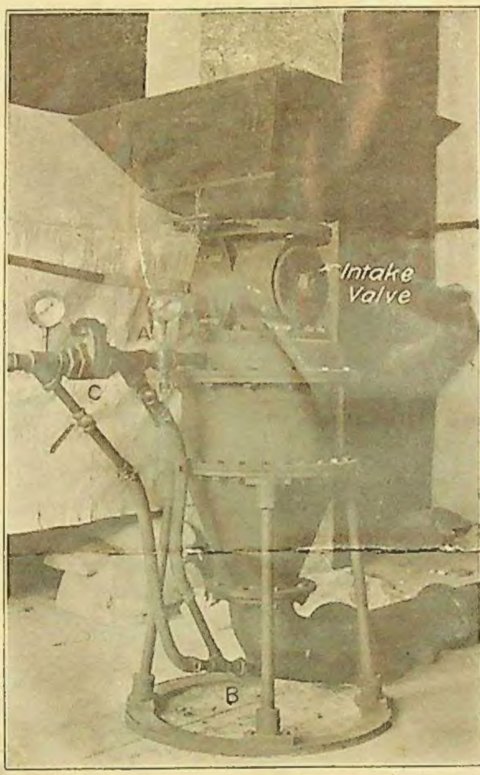
The machine consists of a cast-iron egg-shaped receiver of 6 to 24 cu. ft. capacity, which is filled from above by a hopper through an air-tight intake valve. The dry materials, sand, stone and cement, and finally the proper amount of water, intermingle to a certain extent in passing the valve. The bottom of the receiver terminates in a 6 to 10-in. elbow flanged for connection to the pipe line proper, through which the concrete is conveyed to its place of deposit. The receiver has two connections for the admission of compressed air, one just below the inlet valve marked **A** in the accompying cut, and another opening into the terminating elbow at **B**.

To operate the machine, the material is placed in the receiver and the intake valve closed, thus sealing it at the top. Compressed air under a pressure of 40 to 60 lb. per square inch is admitted at both **A** and **B** by opening a valve marked **C**. The air coming through **A** at the top forces the material toward the elbow, and the air entering the elbow at **B**, escaping through the pipe line at a speed of 1000 to 2000 ft. per second, hits the material and produces in it by the impact an initial velocity said to be as high as 30 to 40 ft. per second. As the materal travels in the pipe line it is mixed with nearly double its volume of air, which reduces considerably the frictional resistance of the pipe line. To empty the receiver into the pipe line takes, it is said, from 1 to 2 seconds, and inasmuch as the materials travel with different velocities owing to the difference in their size, surface and specific gravity, and to the variable amount of friction in the outer and inner portions of the cross-section of the pipe, a thorough mixing is accomplished.

Experiments have been conducted by the inventor in making lime and cement mortars, which are particularly hard to mix in a batch mixer. To the mortar aggregate and also to ordinary concrete material were added small portions of a dry mortar stain. After being shot through the machine, the mortar or concrete is said to present an absolutely uniform color and a thorough mixture is obtained. It is said that the machine mixes the materials just as quickly and thoroughly whether no water, very little or a great amount of water is used.

Conveying the concrete in the pipe line is not accomplished solely by the impact of the air forced in at the elbow, but is also assisted by the expansion of the air from the receiver to the end of the pipe line. This it is claimed explains the fact that concrete can be conveyed vertically to a height of 100 ft. or more, according to the air pressures used. In a horizontal direction concrete has been conveyed 350 ft.

Practice shows that each bend in the pipe should have a radius of not less than 5 ft., in which case no clogging or excessive wear occurs. The first



PNEUMATIC CONCRETE CONVEYOR.

discharge into a clean pipe coats it with ⅛ to ½ in. of mortar. This accumulation is diminished, augmented and displaced by the succeeding charges. At the close of a day's work the pipe line must be cleaned by discharging water through it.

As to the quantity of air required to transport concrete through a 6-in. pipe 100 ft. long, it is said to take about 5 to 6 cu. ft. of free air for every cubic foot of concrete, and probably half as much more for every additional 100 ft. of pipe line.

The machine was used on the bridge piers of the Harvard-Denison viaduct, Cleveland, Ohio, built in 1909 by the Concrete Steel Construction Company, of Pittsburg. In this case the concrete was conveyed from a pneumatic mixer through an 8-in. pipe to an elevation of 80 ft. and air was used under a pressure of 35 to 45 lb. per square inch.

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Engineering Record

On the La Salle Street tunnel work, Chicago, one of the machines was used recently to pump grout under 52 ft. of water into broken stone laid inside cofferdams built over the ends of the tunnel tubes. Before dumping the loose rock into the cofferdam 2-in. pipes were secured in place vertically about 4 ft. apart over the area of the dam. Their lower ends were embedded in the loose rock and extended to within 6 in. of the bottom of the cofferdam. Connection to the conveying pipe was made with a hose pipe. Two 8-ft. layers were grouted in this way. Grout was also forced under the tubes a horizontal distance of 27 ft. Later the same machine was rigged to convey concrete down into the tunnel tubes and discharge the concrete into the crown of the tunnel arch, a maximum horizontal distance from the mixer of 290 ft. and a drop of 35 ft.

An air compressor capable of compressing 275 cu. ft. of free air per minute to 60 lb. pressure is used to operate this mixer. It is claimed that the power cost is about the same as would be required to operate an ordinary batch mixer outfit, and the saving comes in the fact that all the expense of conveying is eliminated. The machine was invented and has been perfected by Mr. J. H. MacMichael. It is built and being put on the market by the Drake Standard Machine Works, Chicago.